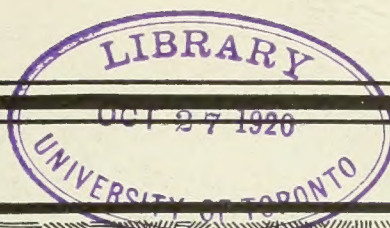


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# THE MIAMI CONSERVANCY BULLETIN

OCTOBER 1920

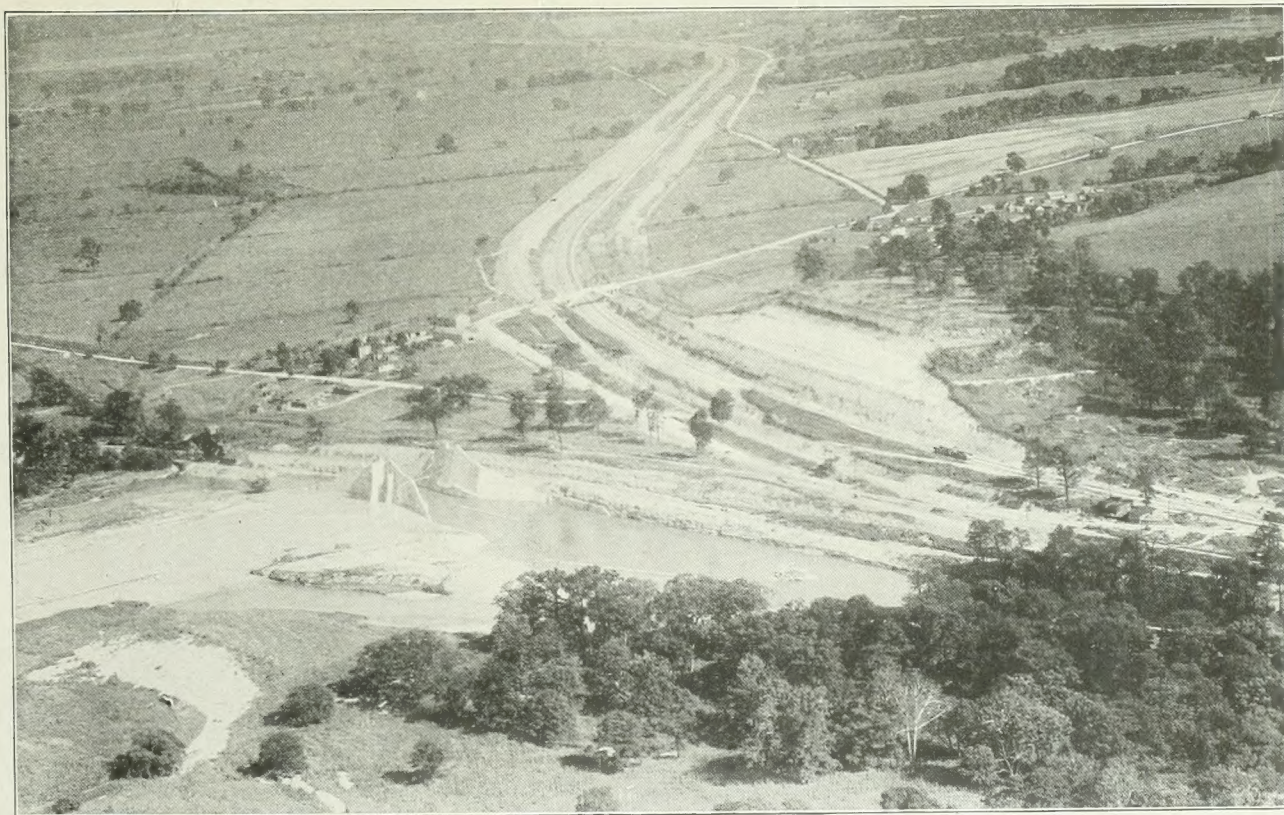


FIG. 197—AIRPLANE VIEW OF BIG FOUR AND ERIE R. R. RELOCATION. SEPT. 17, 1920.

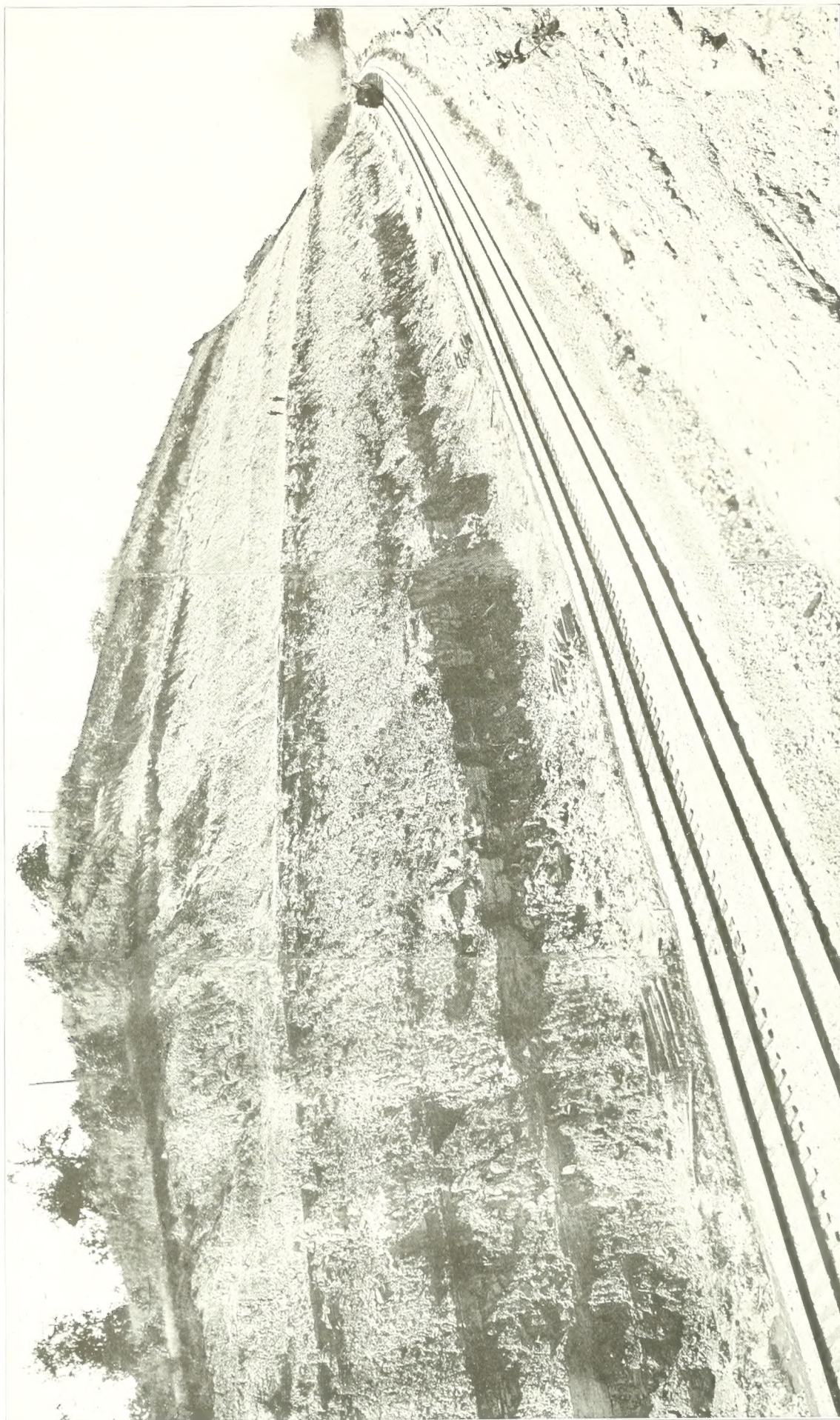


FIG. 198—THE BIG RAILWAY CUT AT HUFFMAN. SEPT. 3, 1920.

This cut is 119.8 feet in maximum height, and 4,500 feet long. It required the excavation of 657,000 cubic yards of material, of which 593,000 cubic yards was rock. The material was taken out by steam shovels and standard gauge 12-yard dump cars, the

work beginning April 15, 1918, and ending September 6, 1919. The rock was drilled and blasted, well drills and Ingersoll steam rock drills being both used. The train was the first, (a passenger over the Big Four,) to go over the new line.

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# THE MIAMI CONSERVANCY BULLETIN

PUBLISHED BY THE MIAMI CONSERVANCY DISTRICT  
DAYTON, OHIO

Volume 3

October 1920

Number 3

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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. Business letters should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to Bulletin Office, Miami Conservancy District, Dayton, Ohio.

G. L. TEEPLE, Assistant Engineer, EDITOR.

### New Levy Made to Finish the Conservancy Work

At a special meeting of the Board of Directors on September 28, it was voted to make an additional levy on the benefitted property of the District, estimated to be sufficient to finish the work of carrying out the Conservancy project, the sum levied being \$10,793,000. The combined benefits of the project, as calculated by the board of appraisal, was about \$76,000,000. A 36 percent levy was made on these benefits, preceding the beginning of the work in January of 1918, creating thus a fund of about \$27,000,000, the estimated cost of the project at that time being \$25,000,000. The great rise in the cost of labor and materials since the levy was voted, however, has made this fund insufficient for its purpose, about \$25,000,000 having been expended in the work to date. Hence the necessity of the new levy.

The amount of the estimate, \$10,793,000, constitutes about 14 per cent on the original estimate of benefits (\$76,000,000), and will be levied as a tax pro rata on the benefitted property of the District. It represents an increase on the original levy of a little less than 40 per cent, and will bring the completed cost of the project around \$35,000,000. In view of the general rise in all costs since the original levy was made, it is considered that the increase is entirely reasonable and in line with the original estimates. It is believed also that in view of the advanced stage of the work, the new levy is final. The construction at the Germantown and Lockington dams is nearing completion, and everywhere is progressing according to program.

The additional assessment will not be included in this year's tax duplicate, but will be added at the earliest to that of December, 1920.

### Big Four and Erie New Double Track Now Operating

The relocated line of the Erie Railway through the Huffman retarding basin was put in operation on October 4. This is the west bound line of the new double track system now operating between Dayton and Enon, the Big Four being the east bound line and the two being operated as a unit. The tracks are parallel, 14 feet between centers from Dayton to about a mile east of the Huffman dam, and 60 feet between centers beyond that point. The total length of the relocated line is 15.22 miles, and the total cost of construction, including damages to the railways on account of necessarily increased cost of operation on the new lines, cost of maintenance during construction, etc., is \$3,234,094. The new Big Four track (the east bound line), was put in operation September 3. The old Erie line will be temporarily used as a west bound passing track between Dayton and Enon, pending the finishing of the new west bound passing track at the new Fairfield station. The latter will hereafter be known as Osborne.

The town of Osborne will hereafter get passenger service only from the Ohio Electric line, and freight service from occasional freight trains over the old steam lines until the latter are taken up. The Ohio Electric service to Osborne will be abandoned next spring.

Wilbur Wright Aviation Field will have a temporary connection to the new steam lines just this side of the new Osborne. This is now under construction. A special, direct, permanent steam line will connect the two places later, for freight service.

The new Erie passing track at new Osborne will be finished by October 9, and the old Erie track torn up by October 18. The work on the Huffman dam embankment, partly held up by the railway gravel requirements, will then go ahead full speed.

#### **Walls and Outlet Structure of Taylorsville Dam Conduits Completed**

The walls and piers of the Taylorsville dam concrete outlet were completed on September 25. The hydraulic jump pool and stilling pool structures at the downstream end of the outlet having been finished some time since, this completes the outlet structure, except for the spillway. In order to leave ample waterway between the walls, thus preventing possible overtopping of the earthen dam embankment during construction to its injury, the spillway will not be built until the embankment is completed. It will require about 4,000 cubic yards of concrete.

The total quantity of concrete in the walls, piers and pool structures, in the present condition of the outlet, is 45,000 cubic yards. The length of the structure is 550 feet and its extreme width is 215 feet and its height, from the bottom of the foundation 82 feet.

The outlet structure at Taylorsville is the largest of all the outlets at the Conservancy dams, providing four openings side by side, each 15 feet in width by 19 feet, 2 inches in height, to take the flood flow of the Miami River, at spillway level equal to 53,600 cubic feet per second. On account of peculiar conditions it was the last to be begun, and is consequently the last to be completed. Its completion therefore marks another distinct forward step in the carrying out of the project.

#### **The Conservancy Farm Lands Proving Attractive**

The Farm Division has recently got out an attractive illustrated circular of 20 pages, giving additional information regarding the Conservancy farm lands which are on sale. The interest shown in these lands has been widespread, inquiries being received from localities scattered from Connecticut to California and from Saskatchewan to Tampico, Honduras, and the Panama Canal Zone. Sale is proceeding steadily, and it is expected that the interest during the coming months of fall and winter will increase still more, due to the fact that possession of the sold lands will be given on March 1, 1921. The fact that these lands are highly improved properties, in a particularly prosperous and fully developed region, is making them an attractive investment.

#### **Airplane Pictures of the Railway Relocation**

The airplane pictures shown on our front cover, and in Fig. 199, we are able to present through the courtesy of the Photographic Branch of the Equipment Division, Air Service, U. S. A., McCook Field. They were taken in the course of the regular photographic flights over the Mad River valley, yet in special shots to bring out the relation of the new

railway lines to the topography of the valley, and the relocation problem which the building of the Huffman dam presented to the Conservancy engineers. The big hill at the right in the frontispiece is the south buttress of the dam and furnished the only practicable "jump off" for the dam site between Dayton and Springfield, 22 miles up the valley, the topography of the valley elsewhere being broad and flat. The building of the dam forced the railway lines 400 feet to the southward, into the hill. See also page 37.

#### **Germantown Embankment Nears Completion**

The work of building the earth embankment of the Germantown dam is rapidly nearing completion, the embankment being now less than fifteen feet from the finished crest level. The material is still being deposited by pumping, as usual, but sand and gravel from the beaches is being picked up by the small dragline excavator which builds up the core pool levees, and dropped into the pool. The latter being now very narrow by reason of the gradual encroachment of the beaches, the deposit in it of the beach gravel is practically making the upper layers of the core into an arch of "mud concrete," spanning the clay materials below, and furnishing solid foundation for the highway which will be built along the top of the dam. Observations and experiments on core materials continue to furnish evidence of a satisfactory solidification.

#### **Black Street Bridge, Hamilton**

Attention was called in a recent Bulletin to the open excavation for Pier 3 of the new Black Street bridge at Hamilton. This method was so satisfactory that it has been extended to Piers 2 and 4 adjacent, the excavations being connected so that they can all be unwatered at one setting of the pumps, the latter being located about opposite Pier 3. The pumps are now handling  $4\frac{1}{4}$  million gallons per day from these excavations, an amount equal to the daily water consumption of the city of Hamilton. As soon as Piers 2, 3 and 4 are finished, the river, which now is running in a channel west of Pier 4, will be turned to run between Piers 2 and 4. The work on the piers and abutments is now half completed and will be finished by January 1, leaving only the arches for next season.

All the material for the construction—piling, concrete materials, forms, reinforcing, steel, etc.—is being handled by a cableway. This cableway, recently completed, is working smoothly and satisfactorily. An article description of the work at Black Street bridge is reserved for a future issue of the Bulletin.

#### **New Technical Report Soon to Be Out**

A new Technical Report, probably on the whole the most interesting of the series, has reached the stage of proof reading and will soon be off the press. It is by Professor Sherman M. Ward and Gerard H. Matthes and deals with the design of the retarding basins, dams and improved river channels in their relations as to reservoir capacity and flood flow. These relations, after the study of the great storms of the eastern United States as to rainfall, are of course fundamental to the entire flood prevention project and are certain to prove of unusual interest to the profession.

### The Big Four and Erie Railway Relocation

New Double Track Line 15.22 Miles in Length, Requiring a Total Excavation of 1,340,000 Cubic Yards. The Huffman Cut, 4,500 Feet Long, Totaling 657,000 Cubic Yards, of Which 593,000 Was Rock, the Leading Feature.

The Big Four and Erie Railways run northeasterly out of Dayton up the Mad River Valley. (See general map, Fig. 200). About six miles from the center of the city they reach the site of the Huffman dam, the proposed building of which compelled their relocation. The valley here narrows between steep hillslopes to a width of about 3,400 feet, providing what is practically the only dam site available in the 22 miles between Dayton and Springfield. Everywhere else between the two cities the valley is very broad and flat, forming a natural floor for railway location, which the old lines followed, the Erie up the north side of the river, the Big Four up the south side, the two coming together just west of Enon, and being run in conjunction between Dayton and Enon as a double track system. They struck the Huffman dam site at about elevation 790. The top of the proposed dam was 60 feet higher. (See Fig. 203 and Fig. 204). The maximum permissible gradient on both roads is 0.3 per cent. Starting from the railroad yard in Dayton, the elevation of which could not be changed, this gradient, carried to the dam site, falls 35 feet below the proposed crest elevation. Under such circumstances the prob-

lem of relocation presented by the dam was exceedingly serious. It involved throwing both roads—treated here as one four-track system, to provide for future traffic expansion—some 400 feet south of the south end of the dam, and into the steep hillside, a large percentage of which was rock. Once across the dam site, the new roadbed would find itself within the Huffman retarding basin, 20 feet below the maximum flow line (spillway level), necessitating protection of the tracks by levees on each side for about a mile and a half above the dam, until the continued 0.3% gradient could reach the flow line. The remainder of the relocation is practically one long tangent till the old line at Enon is reached, the work on this portion being most of it light.

The total length of the relocated lines is 15.22 miles. This is an increase over the old length of the Big Four of about 3,540 feet and over the old length of the Erie of about 4,350 feet. Together, the new lines also show an increase over the old in curvature of about 93 degrees. Both of these changes, as well as the increase in length of gradient, involve a permanent increase in operating expense. This increase, capitalized in accordance with the Interstate

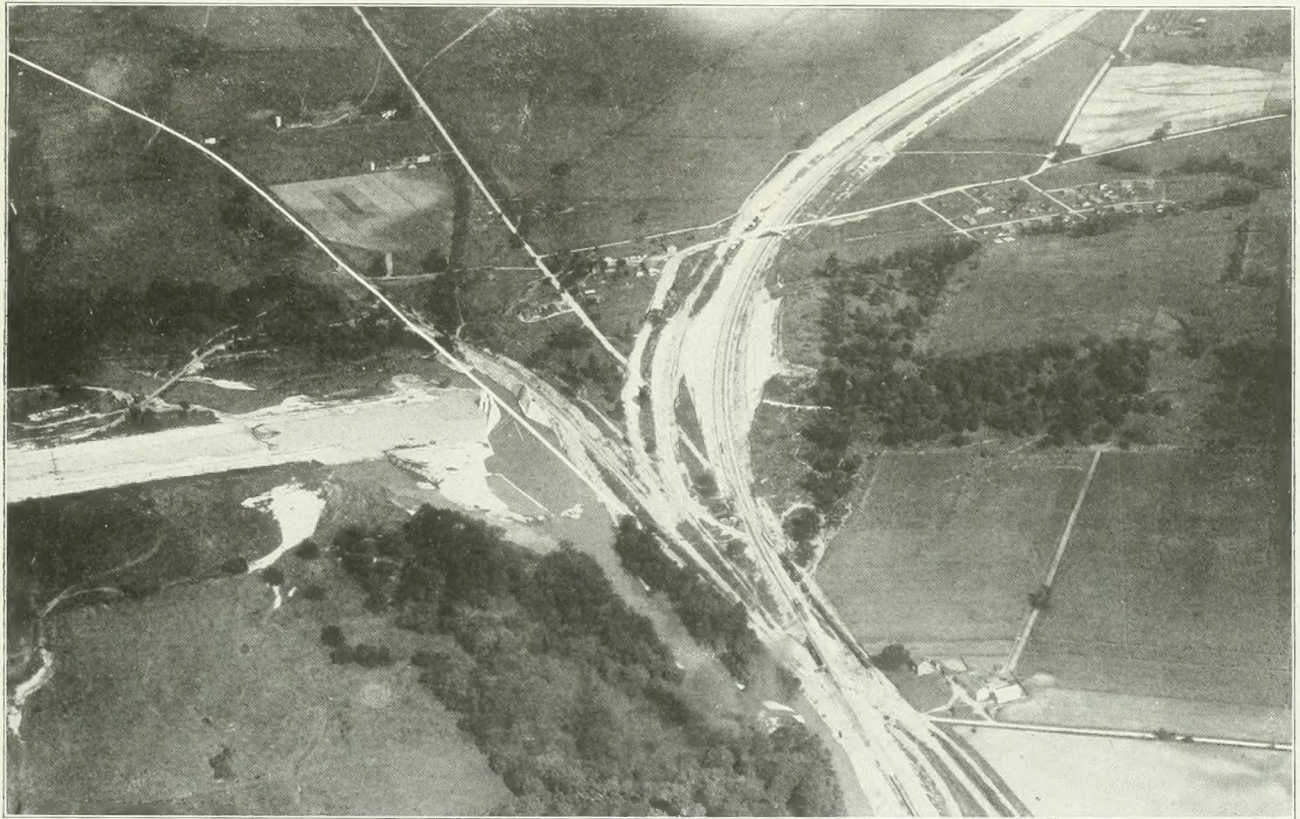


FIG. 199—AIRPLANE VIEW OF HUFFMAN DAM AND RAILWAY RELOCATION. SEPT. 17, 1920.

This view is east, and shows with especial clearness the relation between the old and new locations of the Big Four R. R. at Huffman dam. The old location is shown by the left hand white line. The new one is seen swinging to the right through the big cut and on along the edge of Mad River valley beyond, between the two levees. The middle white line is the old location of the Springfield Pike. The old line of the Big Four is seen to pass directly between the walls of the Huffman dam outlet structure, to the left of the big cut, the uncompleted earth embankment of the dam being the light area running to the left from the walls. Mad River is seen as the darker area coming from the left and running between the walls toward the observer into the foreground. The temporary Big Four location is seen just to the right of the walls.

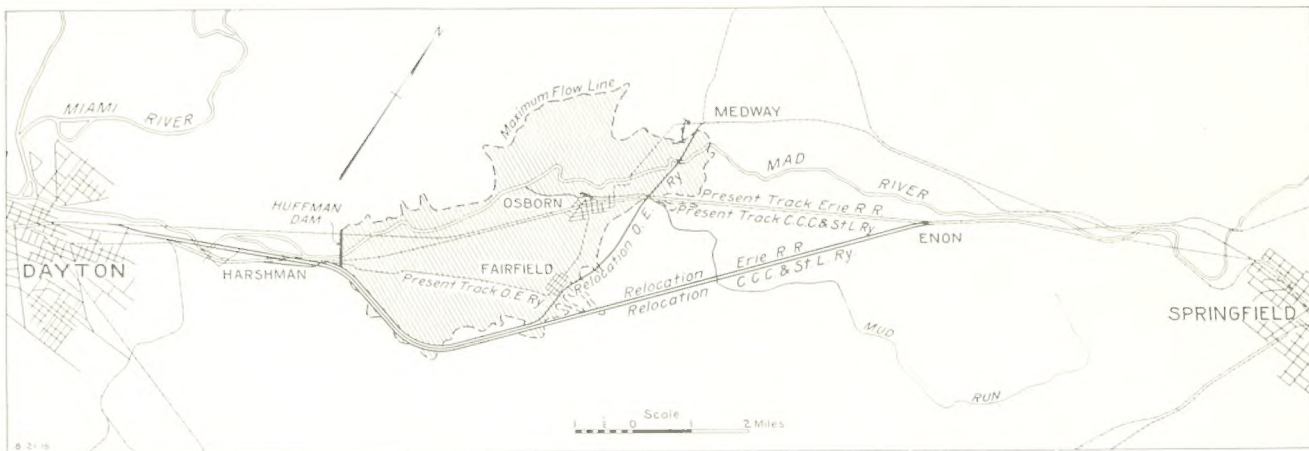


FIG. 200—GENERAL MAP OF THE BIG FOUR AND ERIE RELOCATION.

Commerce Commission's classification, amounts to about \$400,000, which will be paid to the roads by the District as part of the expense of the relocation.

Through the big cut, the roadbed has a width of 72 feet, sufficient to accommodate four tracks on 14-foot centers. Between the levees the cuts are of like width, while the fills are extended from levee to levee, the levees being 200 feet apart on centers, with the drainage between them running back to the mouth of the big cut, since no openings can be permitted into the valley above the dam on account of their admitting flood water. The remainder of the roadbed has 34 ft. width in fill and 44 ft. in cut, to accommodate two tracks.

The old line of the Big Four, indicated by the left white line in Fig. 199, ran directly through the proposed outlet structure of the Huffman dam. It being necessary to begin construction of this outlet at the earliest possible date, a temporary relocation of the Big Four was necessary, since the regular relocation would require over two years to complete.

The temporary relocation is shown in the same figure running just to the right of the outlet works. It was about a mile and a third in length, and required 46,000 cubic yards of excavation, of which 33,800 was rock. It was put in operation in October, 1918.

The total amount of excavation required to grade the new lines is about 1,420,000 cubic yards, of which about 657,000 was in the big cut at Huffman, about 593,000 of this being rock. The latter condition made it uneconomical to balance cut and fill, embankment exceeding excavation, as the work was carried out, by 400,000 cubic yards. The excess was partly obtained by widening the cuts, except the big cut, the rock making the latter too expensive.

Between Dayton and the dam the most interesting features are the two channel changes in Mad River, by which double river crossings are avoided. The excavation on these amounted to 44,000 cubic yards, of which 34,000 was overcast by a clamshell and the rest moved by teams. Another feature is

The view is northwest, the inner (north) levee being at the right. The two levees are 200 feet between center lines, and have a maximum height of 35 feet. They are necessary because the maximum permissible gradient on the Big Four and Erie on this division is only 0.3 per cent, which carried east out of Dayton, (where the track levels could not be changed,) would only lift the relocated lines to an elevation 35 feet below the crest of the Huffman dam. East of the dam, therefore, the tracks would be within the retarding basin and subject to overflow in times of

(Continued below.)



FIG. 201—LOOKING NORTHWEST BETWEEN THE TWO RAILWAY LEVEES. SEPT. 20, 1920.

unusual flood. They are, therefore, enclosed on each side by the levees for a distance of a mile and a half east of the dam. Culverts 275 feet in length carry the drainage water from the hills to the south, under both tracks and both levees.

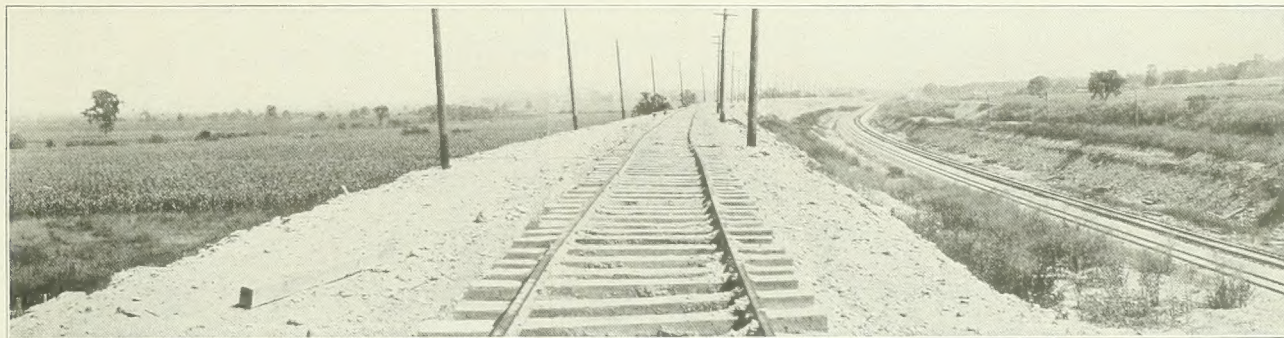
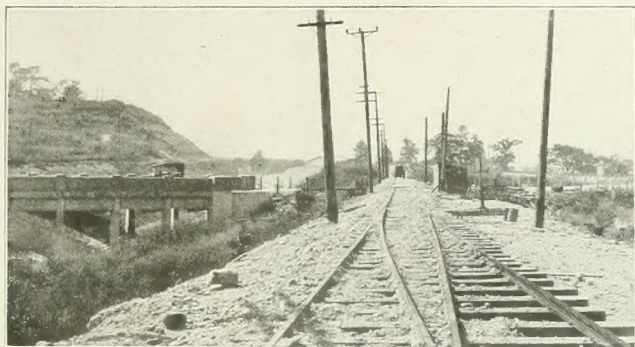


FIG. 202—ON THE OHIO ELECTRIC R. R. TRACK AT HUFFMAN, JUST EAST OF THE BIG CUT. SEPT. 20, 1920.

The two views were taken from the same place on the inner (north) levee, the upper looking west, the lower east, to show the nature of the relocation problem. The hill at the left, above, is the one requiring the 120-foot cut, just at the south end of the Huffman dam. The lower view shows Mad River valley bottom at the left, and the valley side sloping down to meet it at the right, with the steam lines occupying the cut between the two levees in the right foreground. The top of the levee here is ten feet above spillway level, and five feet below the dam crest.

the abolition from the new Big Four and Erie lines of "Dead Man's Crossing" in the outer limits of Dayton, to be completed when the Baltimore and Ohio carries out its contemplated grade separation. All the grading between Dayton and Huffman is embankment, steadily rising across the valley flat to the big cut at the dam. It totals 390,000 cubic yards, of which 106,000 came from a borrow pit at Harshman and 90,000 from the dam outlet excavation; the remainder from the big cut.

Beyond the big cut, the chief features are the twin levees, 200 feet apart, 35 feet in maximum height, and a mile and a half long, the inner one carrying the Ohio Electric Railway relocation. These two

tractor.

The east three miles of the line was in wet, miry material, obtained from side borrow by elevating grader, and built into a narrow embankment, widened later by side dump from the cuts west, using steam shovel and dump cars. This was done by George W. Condon, by Condon and Kolterman, and by Condon and Ward.

The big cut in the hillside at Huffman was by far the dominating feature in the work of construction, the topography elsewhere being mostly broad, flat valley. On the high side the cut reaches a maximum depth of 119.8 feet. Its total length is 4,500 feet. The underlying rock in many places reaches to the

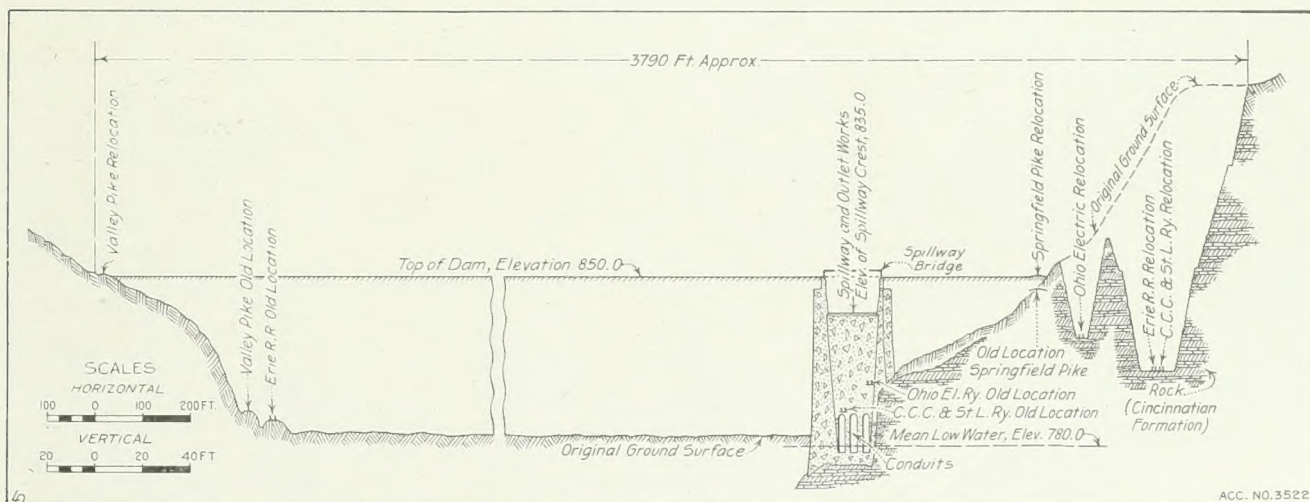


FIG. 203—CROSS SECTION OF MAD RIVER VALLEY ALONG CENTER LINE OF HUFFMAN DAM.

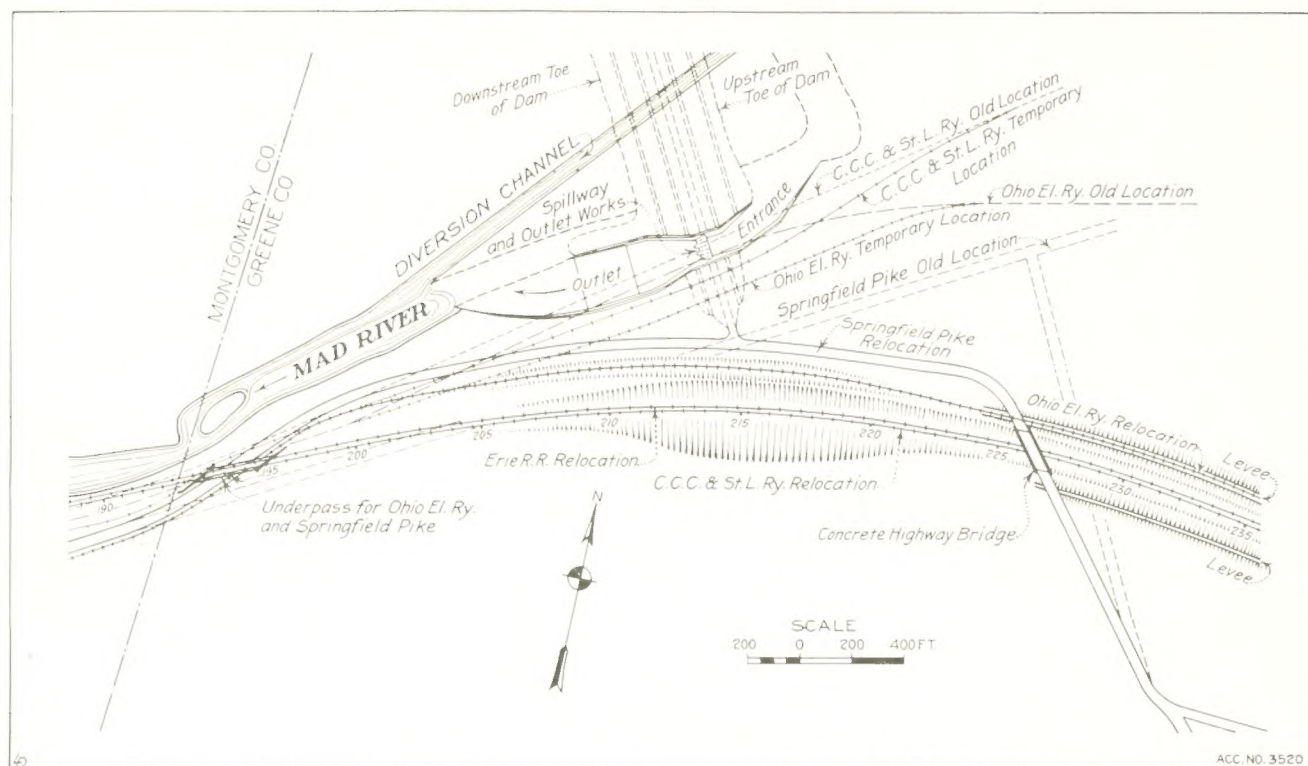


FIG. 204—MAP OF RAILWAY RELOCATION AT HUFFMAN

grass roots. The excavation totalled 657,000 cubic yards, of which 593,000 was rock. Its finished appearance is shown in Fig. 198 and various features of the work in Fig. 210.

The rock is of three formations, the Brassfield, the upper, about 35 feet thick, of the Silurian group, with the Elkhorn, about 44 feet thick, and the Cincinnati, about 41 feet thick, in order below, the two latter of the Ordovician group. The Brassfield is a fairly solid limestone, and was excavated on a one-to-one slope, with an 8-foot berm at its foot. The Elkhorn is a much softer stone, somewhat greasy in texture, so that it had to be given a  $1\frac{1}{2}$ -to-1 slope, with a four-foot berm at its foot. It was possible to excavate it by steam shovel without blasting, but its toughness made this so uneconomical that blasting was resorted to in fact. The Cincinnati consisted of limestone layers inter-laminated with shale, making a formation which on first exposure was quite hard, but softened and sloughed rapidly on exposure to the weather, so that in a month it could be kicked to pieces with the foot. It was stable enough to stand on a 1-to-1 slope, which was used.

All the rock required drilling and blasting, mostly done in 8 or 16-foot lifts, the latter height being used when the steam shovel stood on a level with the cars it was loading, the former when the cars stood on the shelf above. Forty per cent dynamite (DuPont or Aetna), was used, in charges of 100 to 250 pounds, the holes being mostly (ninety per cent) sprung for the charge. Ammonia dynamite was used at first, but the occurrence of many springs of water compelled recourse to gelatine dynamite for most of the work. Holes were spaced about 7 feet for the 8-foot lifts and about 13 feet for the 16-foot lifts. The bottom 28 to 30 feet of the rock was shot in one lift, 2,500 feet in length. Five Ingersoll E-44 steam

drills and four well drills were used, with two jack hammers for lighter work. The well drills made 40 to 50 feet in a ten-hour shift; the rock drills from 60 to 65 feet, the holes being  $3\frac{1}{4}$  to  $3\frac{1}{2}$  inches in size. The lower left picture in Fig. 210 shows especially well the thorough disintegration produced by the blasting, in this case in the 28 ft. layer, the material being just lifted and left in a loose windrow which the steam shovel handled readily.

The shovel used for most of the work was the 70-C (about 70 ton) Bucyrus, a type especially fitted for rock excavation. Two of these machines were used for the first three months of the work on one 10-hour shift. One shovel was then substituted, working day and night. The machine removed about 4,000 cubic yards per 10-hour shift, and averaged about 34,000 cubic yards per month. A small Erie shovel assisted on the rock for the Springfield Pike fill and the levee embankments. The entire material was transported in standard gage 12-yard dump cars (Western), hauled by locomotives, and was used in making the embankments east and west, and the two levees. The work was done by the Walsh Construction Co., of Davenport, Iowa, general contractors for the grading, track work and ballasting on both the Erie and Big Four, under the general superintendence of Mr. W. A. Durkin. It is noteworthy that not a man was seriously injured in the entire course of the job. The grading was begun April 15, 1918, and finished September 6, 1919.

The track laying was done by Roberts Brothers of Chicago, who took the contract for this feature under the Walsh Construction Co., following similar work on the Baltimore and Ohio relocation. This work on the Big Four and Erie was begun in Oct., 1919, and completed March, 1920. A picture and de-

scription of the Roberts tracklaying machine was given in the issue of September, 1919.

The new track on both the Big Four and Erie includes 15.22 miles of main line, with 1.51 miles of side tracks on the Erie and 1.36 miles of the same on the Big Four, in the new yard at Fairfield. The rail on both roads is 90 pound A. S. C. E. open hearth steel, with the side tracks of 90 pound repair steel, the latter being obtained from the old yards at Osborne. The ties on the Big Four are creosoted, 8' 6" long, and averaging 7"x8", laid 20 to the 33 foot rail, with suspended joints, the two ties at the joint being 14" center to center. On the Erie they are 8' 6" long and at least 7"x8", untreated, spaced 18 to the 33 foot rail. Standard tie plates are used on all curves on both roads. On the Big Four anti-rail-creeper were placed on all rails, of the P. and M type, four to the rail. The angle bars are standard 24", 4-hole, on the Big Four of the continuous type, and on the Erie of the Erie standard; the track bolts with square heads and rolled threads.

The ballast is gravel, obtained from the valley borrow pit supplying material to the Huffman dam. A minimum of 12" was required below the bottom of the tie, equivalent to 3,490 cubic yards per mile of single track. The work of supplying it took all the time of the day shift in the borrow pit and part of that of the night shift, and was the cause of some delay in the building of the dam embankment. The excavation was done by the District's own forces, the transportation and placing by the Walsh Construction Co. under its contract.

The total cost of construction of these two relocated railways is about \$2,717,120. This includes grading, tracks and tracklaying, ballasting, concrete structures, fencing, telegraph lines, and interlocking plants. To this must be added damages to the railway companies on account of increased cost of operation over the new lines, extraordinary maintenance during construction, etc., amounting to \$579,974, totalling with the construction cost, \$3,237,094.

This does not include the cost of the right of way, amounting to 345 acres. Estimate of this it is not possible to present at this time, much of it being purchased along with the farms bought by the District in the Huffman retarding basin.

The railways and the Conservancy District being all three vitally interested in the relocation, all had engineers overseeing the work. For the Big Four, the representatives were G. P. Smith, Consulting Engineer, and W. B. Hodge, Resident Engineer. The interests of the Erie were looked after by C. H. Splitstone, Superintendent of Construction, and by Messrs. C. B. Miese and C. J. McCabe, successive resident engineers. For the Conservancy District the work was at first in charge of E. N. Floyd as Division Engineer, succeeded in November, 1918, by Albert Larsen, the assistant engineers being successively William Yount and W. D. Kramer, with Olaf Froseth as Office Engineer.

Features of the relocation especially concerning the Ohio Electric Railway and the valley highways will be treated at a later date.

## August Progress on the Work

### GERMANTOWN

During the month of August, 31,680 yards of hydraulic embankment were pumped into place on the dam. This yardage is made up of eight days' pumping from dragline excavation, and 17 days from hill sluicing alone. The total yardage up to the end of August was 701,420 cubic yards, making the dam 88.9 per cent complete.

Both the upstream and downstream slopes of the dam have reached elevation 810, which is just 20 feet below the top of the dam. The small dragline is now throwing up a 5-foot lift on the 2:1 slope of the upstream slope.

The large dragline is excavating material for the dam from the new borrow pit opened up on the island, getting a good run of gravel.

Concreting of the spillway bridge was started during the month. Piers 2, 3, 4 and 5 have been poured up to the caps. A portion of the cut-off trenches in the spillway channel has also been concreted.

The spillway excavation is now complete, Daniels moving the last of his equipment August 28th. Mr. J. C. McCann has also finished the grading on Road No. 2 and moved his equipment into camp August 30th, for leveling off spoil banks adjacent to the outlet works.

A. L. Pauls, Division Engineer.

September 20, 1920.

### ENGLEWOOD

During the month ending August 25, 154,000 cubic yards of embankment were pumped into the hydraulic fill. The rolled embankment in the cross dam amounted to 7,000 cubic yards, making a total for the month of 161,000 cubic yards of earth placed in the dam. The total at the estimate date, August 25, including all classes of embankment, aggregated 1,765,000 cubic yards, or 50.4 per cent of the completed dam.

The embankment in the river closure has reached elevation 839, 71 feet above the river bed. With the temporary spillway and conduit in service this amply insures safety against overtopping even in the event of a repetition of the 1913 flood.

Cross dam No. 2, on the right bank of the river, has reached elevation 844, six feet below its projected height.

A few weeks will see the completion of this piece of work. Dry rubble paving at the entrance to the outlet conduits has been started.

The embankment in the river closure has reached nearly to the elevation of the portion of the dam constructed last year and preparations are in progress for including that section in the filling operations during the remainder of the season. When this shall be done 3,000 lineal feet of embankment will be in progress at the same time, utilizing in sequence both pumping plants.

H. S. R. McCurdy, Division Engineer.

September 15, 1920.

### LOCKINGTON

There were 62,000 cubic yards placed in the dam by hydraulic pumping during August. The truss bridge over the outlet structure for carrying the dredge pipe to the west part of the dam was raised on September 13. Clay material of a very hard character has been encountered in different parts of the borrow pit.

The stone surface dressing or rip rap on the slopes of the dam is progressing satisfactorily.

Some work is being done on Roads 8, 9 and 10 by Contractor Ryan pending commencement of the large fill on Road 9. The work consists mostly of reshaping the surface and regrading the fills after a season's settlement. A relocation of Road 11 has been approved by the commissioners of Shelby county.

Barton M. Jones, Division Engineer.

September 25, 1920.

### TAYLORSVILLE

The concrete outlet works were completed on September 25, with the exception of the spillway. The west wall was finished on August 30, the east wall proper on August 14, an extension of this wall on September 25, and the three piers, containing about 2,000 cubic yards, on September 24. The latter were carried up to the springing line of the conduit arches, about 18 feet above the conduit floor.

Over 2,000 cubic yards of concrete were placed during the month, bringing the total to about 45,000 cubic yards. The spillway will add about 10,000 cubic yards to this.

The Lidgerwood Class M dragline has finished the excavation of the inlet channel to the conduits to station 3, a distance of 300 feet in all.

The building up of the earthen cross dike enclosing the hydraulic fill pool on the east, was again started on Sept. 23. This dike will now be carried up to its full height, at elevation 820 (the dam crest being at 837). The material is being transported from the inlet excavation in 12-yard dump cars, and placed in the dike by a locomotive crane rigged with a clamshell bucket.

The hydraulic fill is progressing at about the same rate as last month, the work being on the section between the cross dike (on the west bank of the Miami) and the west valley slope.

Mr. Crampton has completed the grading of Road Number 12 to station 59

W. J. Smith, Assistant Engineer.

September 26, 1920.

#### HUFFMAN

During the month of August 40,000 cubic yards of material were placed in the dam, 12,000 cubic yards of this being sluiced directly into the dam from the hillside at the north end of the dam. The balance was pumped through the main pumps by the night shift. A part of the night shift, as well as all of the day shift, has been engaged in getting out material for the railroad work.

The 1½-yard steam dragline has completed building the upstream levee up to elevation 806 in the section north of the old diversion channel and up to the 800-foot berm in the river closure section. It has also sloped up the north bank of the entrance channel to the outlet works in preparation for covering it with rip rap.

The new location of the Springfield Pike west of the dam has been graded sufficiently to allow light traffic to pass through. It cannot be entirely completed so as to open it to the general public until after the Ohio Electric has been shifted to its final location.

C. C. Chambers, Division Engineer.

September 24, 1920.

#### DAYTON

Dragline D-15 is excavating a trench for the Beach Avenue river wall foundation. D-16 is excavating from the channel and placing the material as backfill at South Robert Boulevard wall and as embankment for the proposed revision of the street grades between Fourth and Fifth Streets. D-19 is finishing the channel excavation west of Main Street along the north bank of the river. The material is being used for enlarging the Lehman Street levee. A considerable portion of the levee embankment will be moved with cars.

Good progress has been made on Sunset Avenue retaining wall, 272 cubic yards of concrete having been placed. At Stillwater Drive river wall 745 cubic yards of concrete have been poured.

Finke Engineering Company is cleaning up the channel excavation and levee embankment at the old launching basin near Herman Avenue.

Price Brothers have started driving piles for revetment on the north bank of the river east of Dayton View bridge.

To date 38,800 cubic yards have been issued from the gravel pit.

#### Summary of Excavation and Embankment

	Previous to Aug. 1 cu. yds.	During August cu. yds.	Total to Date cu. yds.
Pay quantity in levees and spoil banks .....	588,000	17,000	605,000
Levee embankment (In- cludes Contract No. 41) ..	75,900	100	76,000
Total yardage handled.....	1,522,000	78,000	1,600,000

None of the figures includes 105,000 cubic yards of excess excavation for launching basins and scowing canals.

C. A. Bock, Division Engineer.

September 20, 1920.

#### HAMILTON

The total of Item 9, channel excavation, to September 1st, was 740,000 cubic yards.

The electric dragline, D-16-18, is at present loading cars on the west side of the river, between the Columbia bridge and the railroad bridge.

Excavation and pile driving for Pier 4, Black Street bridge, have been completed by Dragline D-16-17, and the excavation for Pier 2 is 75 per cent completed. The cableway was placed in operation on September 13th and has been used for concreting part of Pier 3 and the footing for Pier 4. The excavation for Piers 2, 3 and 4 is being done by the dragline in such a way that all the piers are enclosed by one coffer dam and are being pumped out from one setting of the pumps. The pumps are handling about 4½ million gallons daily, or the equivalent of the daily consumption of the city of Hamilton.

Work has been started on the excavation for lowering the 24-inch water main across Old River, west of the B. & O. bridge.

Excavating and concreting are being continued on the Black-Clawson wall.

Price Bros. have turned out 105,000 blocks at their block plant. The work of laying the blocks and the slope revetment on the east bank between the railroad and the Main Street bridge is nearing completion.

C. H. Eiffert, Division Engineer.

September 20, 1920.

#### LOWER RIVER WORK

Miamisburg.—Jeffrey, Boorhem & Co. have practically completed their contract for construction of local protection works on the west side of the river. A few days' work will be required to finish dressing and seeding levee and road slopes and surfacing roads. The work on the west side of the river consists of 3,500 lineal feet of levee averaging about 14 feet in height, and 2,400 lineal feet of gravel surface roads. It was also necessary to raise a spur railroad track over a distance of 700 feet a maximum of 10 feet at the center. The work was begun about a year ago.

Cole Bros. are erecting their dragline machine on the east side of the river and will be ready to throw dirt in a week or ten days. They will start about at the north corporation line, just west of the C. & D. traction embankment, and work down the river. They have the contract for all the dragline work on the east side.

Franklin.—Jeffrey, Boorhem & Co. have placed about 8,000 cubic yards of material in levee embankment between Park Avenue and Pine Street during the past month.

Middletown.—Cole Bros. have moved their equipment to Miamisburg, having completed their work here with the exception of a small amount of dressing and seeding.

Price Bros. have finished the pile driving for the revetment and have laid about one-third of the concrete blocks, of which 6,400 will be required for the flexible revetment.

F. G. Blackwell, Assistant Engineer.

September 25, 1920.

#### TROY

Clapp, Norström & Riley completed their part of the work on August 21. Their total pay excavation amounted to 106,000 cubic yards and their pay embankment to 44,000 cubic yards. Practically all their equipment was purchased by the District, and will be used here and at other points, as needed.

The remaining dragline work has been let to Mr. Donald Jeffrey on a percentage basis, and he started to work September 2. The levee embankment below the B. & O. railway bridge, on the right bank, has been completed, and the machine is now starting a fill for crossing the river channel. The deep water channel from the B. & O. bridge to the head of the cut-off channel will then be completed, after which the dragline will cross over the B. & O. railway fill at the north end of the river bridge, and commence excavating the deep water channel between the B. & O. bridge and North Market Street.

The total yardage excavated from the river channel, between Market and Adams Streets, by the C. & C. Haulage Co., is 27,000 cubic yards. This material has all been placed in the embankment between Market and Adams Streets, except for 850 cubic yards, which has been placed in levee embankment on the west side of the B. & O. railway fill, to form a grade for the dragline crossing.

The Finke Engineering Co. has placed 10,500 cubic yards of material in the south levee along Morgan Ditch. The first 800 feet of this levee is practically complete, except for top soil and shaping the slopes.

The contract for the Pearson Levee has been let to Wm. Oberer of Dayton. This is a low levee, averaging five feet in height, crossing the southwest corner of the Pearson

farm, just east of the Bradford bridge. The new levee will be the same height as the original levee along that side of the river, but is located some distance east of the original levee to make a wider opening for flood water at that point. The contractor started work with a four team outfit on August 21 and has completed 900 feet of levee, or placed 2,500 cubic yards of embankment to date.

A. F. Griffin, Assistant Engineer.

September 15, 1920.

#### RAILROAD RELOCATION

**Big Four and Erie.**—All eastbound trains of the Big Four and Erie have been operating over the new line with the exception of three local passenger trains which operate over the Erie against the regular current of traffic to Osborn and then over the old Big Four line to Enon. All westbound trains of these two railroads, and the three eastbound trains, will be diverted to the new line October 1, 1920. The ballast is complete with the exception of the yard tracks at Fairfield. The old side track material at Osborn is being used for the new side tracks at Fairfield. The District forces are removing these tracks at Osborn. The Big Four side tracks at Fairfield are laid and the passing track will be ballasted by the 1st of October.

The gap in the line at Huffman, where temporary timber structure was built at the underpass for the temporary main track, is completely filled, and the temporary Big Four main track is almost all removed. The removal of the Big Four temporary main track made it possible to begin construction of the new Springfield Pike at Huffman, and Mr. Connelly's team outfit started grading on the 16th of the month and it is now passable for vehicles. The Springfield Pike had been closed for more than a year.

The Big Four yard tracks just east of Findlay street, are also being raised and nearly all the ballast has been hauled for the yard.

The signal systems at Fairfield and Tate's Point are practically complete and are in operation.

**Baltimore & Ohio Railroad.**—The track south of Taylorsville dam has been removed, the railroad taking all of

the rails, angle bars, and tie plates, and the best of the ties. The remainder of the ties are being sent to Englewood for the temporary spillway and to other features for construction tracks.

**Ohio Electric Railroad.**—Work on the electric line has been practically suspended during the month, the contractors' forces working on the steam railroads, and the District's trolley line forces on other District work. Work is being resumed and it is expected to complete for operation the Ohio Electric from Huffman to Fairfield by November 1.

Albert Larsen, Division Engineer.

September 27, 1920.

#### RIVER AND WEATHER CONDITIONS

The rainfall in the Miami Valley during the month of August varied from 2.18 inches at Fort Loramie to 5.08 inches at Ingomar. At Dayton it amounted to 2.64 inches, or 0.37 inches less than normal, bringing the accumulated deficiency since January 1 up to 2.80 inches.

Unusually heavy precipitation occurred at Hamilton and just north of Springfield during the evening of the 21st. At Hamilton  $4\frac{1}{2}$  inches of rainfall was reported. At Springfield, the total amounted to 2.75 inches, causing a rise of about 10 feet in Mad River. Owing to the comparatively small area on which the heavy rainfall occurred at Hamilton, the Miami at that place only rose about four feet.

Observations taken at the local office of the U. S. Weather Bureau, show that the mean temperature for the month was 71.1 degrees, or 2.3 degrees less than normal; that there were seven clear days, seventeen partly cloudy days, seven cloudy days, and thirteen days on which the precipitation amounted to or exceeded 0.01 of an inch; that the average wind velocity was 7.3 miles per hour, the prevailing direction being from the northwest; and that the maximum wind velocity for five minutes was twenty-six miles per hour from the northwest on the 31st.

Ivan E. Houk, District Forecaster.

September 25, 1920.

### Evidences of Sea Life at the Huffman Dam

The coral whose photograph is presented here was found seven miles east of Dayton, in the deepest part of the excavation for the jump pool on the down-stream side of the Huffman dam. The figures are only one-third as large in diameter as the actual specimen. The right-hand figure shows the exterior surface; the left-hand figure shows the interior structure of the same specimen.

The level at which the coral was found is 107 feet above the base of the Monument, opposite Steele High School on Main street. Since the latter is 750 feet above sea level, this coral was found about 857 feet above present sea level.

Corals evidently are sea animals, hence their occurrence far above present sea level and at great distances from the ocean requires explanation.

As a matter of fact, evidences of sea life are common in the rocks around Dayton. It is evidences of land animals and land plants which are absent here, no traces of land animals or plants ever being found in rocks nearer than 75 miles from Dayton in any direction. However, the remains of sea life occur frequently in the rocks even at the highest elevations around Dayton. Many have been described and figured from the abandoned quarry at the Soldiers' Home and from still higher elevations.

Geologists find abundant evidence that all of Ohio and of the neighboring states repeatedly was covered by oceanic waters for long periods of time. During those periods oceanic waters must have been of greater depth or the continental masses must have had much lower elevations so that their lower parts

were below sea level. Among geologists the second theory finds most favor, although there may have been a combination of both causes operative in bringing Ohio below sea level.

The coral here figured was found by T. C. Shuler, of the engineering force at the Huffman Dam. The same kind of coral has been found at numerous localities in southwestern Ohio, but it is much more

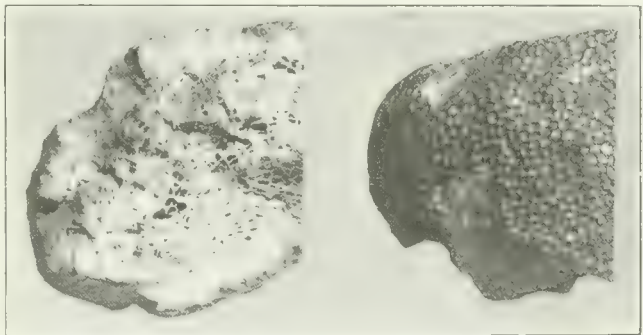


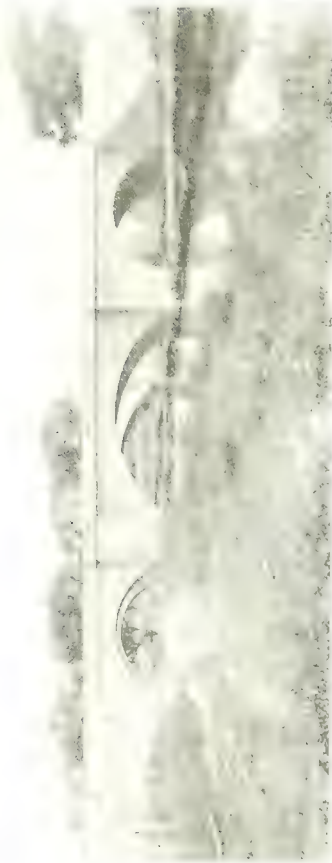
FIG. 205—FOSSIL CORAL FROM HUFFMAN DAM EXCAVATION.

abundant near Madison, Indiana, on the Ohio river, and from that point southward for a distance of fifty miles. There it occurs in such great quantities in the rocks that geologists refer to this region as an area of coral reefs. Many million years have passed since Ohio was below sea level.

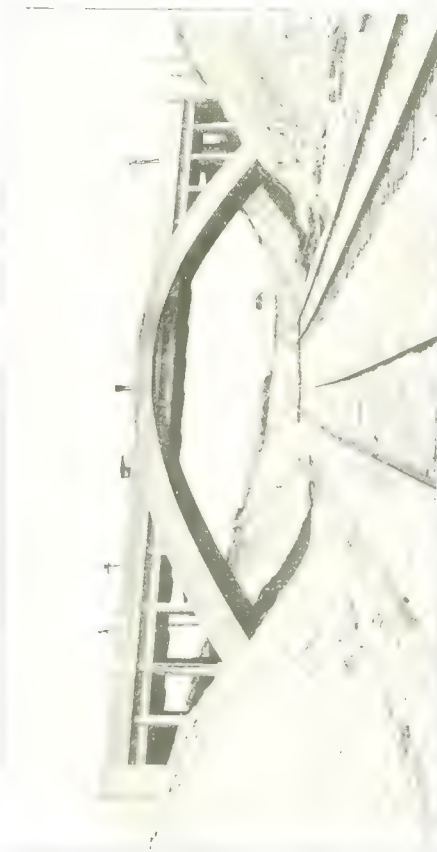
August F. Foerste.



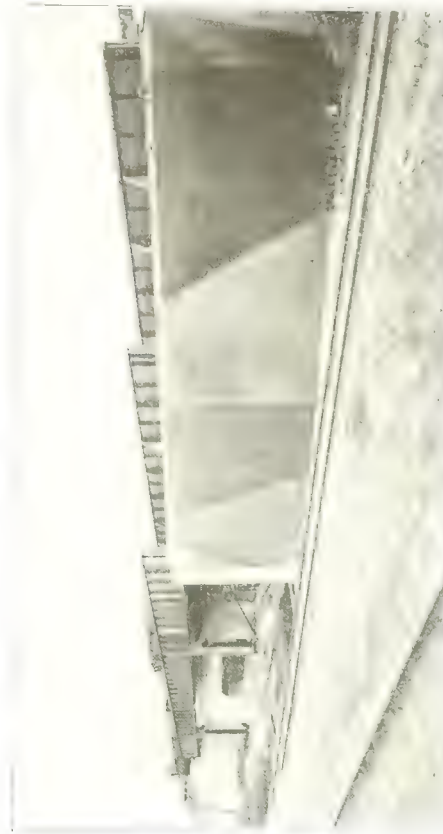
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1



3



4

FIG. 206—NEW BRIDGES ON THE BIG FOUR AND ERIE RAILWAY RELOCATION.

Number 1 is the new double bridge at Mud Run, really two separate structures, one for each railway, which here are 60 feet apart. The center arch is 40-foot span, the side arches 25-foot span. Both bridges are 20 feet wide. Picture taken September 20, 1920.

Number 2 is the triple box culvert at Tates Point at the northeast city limit of Dayton. The culvert openings are of 12-foot span. Picture taken September 20, 1920. Number 3 is the highway bridge spanning the eastern entrance to the big cut at Huffman dam. It was fully described in the Bulletin for August, 1920. It is a three-hinged arch, the two arch ribs being entirely cut in two transversely at the two abutments and at the top of the rise, with a pin and ring joint inserted at each of the cuts. The entire thrust of the arch is thus borne by two bronze pins 21 1/4 inches in diameter and 28 inches long, at these cuts. By this design temperature stresses in

the arch, which frequently crack the ordinary type of barrel arch, are avoided. The roadway is 18 feet wide and carries the relocated Springfield Pike. Picture taken June 26, 1920.

Number 4 is the underpass just west of the big cut at Huffman dam, which carries the relocated Springfield Pike and the Ohio Electric Railway under the relocated Big Four and Erie lines. The center concrete pier separates the highway and the electric line. Two spans of steel "through girders," each 45 feet long, and 6 feet in height, extend over the highway, supported at the highway center line by steel "bents." Two similar spans, 38 feet long, and similarly supported between the two tracks, carry the bridge over the electric line. Picture taken February 18, 1919.

The three-hinged arch was designed in the offices of the District; the other bridges in the offices of the Big Four Railway.

## The New Big Four and Erie Railway Bridges

The most striking bridge on these lines is the hinged arch highway bridge spanning the big cut at Huffman, described in the Bulletin for August, 1920. The other more important structures are described below. Like all the railway bridges, they are built to carry Cooper's Class E-70 loading, with the impact allowances of the 1917 New York Central Specifications. They were designed in the offices of the Big Four Railway, subject to the approval of the Conservancy engineers. They are illustrated in Fig. 206.

**The Huffman Underpass.** This was provided to carry the Springfield Pike and the Ohio Electric R. R. under the grade of the Big Four and Erie. Inspection of the cross section and map in figures 203 and 204 will make clear the necessities of highway relocation in the case, to provide grade separation, and lift the Pike out of the Huffman retarding basin on reasonable grades. The underpass is the only bridge on the relocated railways having a steel structure, a design introduced here for economy. The location is just west of the big cut, the Big Four and Erie being here on tangent, rising toward the cut on a three-tenths grade. The bridge is of the through girder type, with four spans of three girders each, built on a skew of 65 degrees from the normal. Two 45-foot spans go over the highway, and two 38-foot spans over the Ohio Electric line, the highway and the O. E. tracks being separated by the large central concrete pier, while the quarter points, located on the center line of the highway and of the electric railway tracks respectively, are supported by steel bents, thus minimizing the obstruction to the under traffic, while securing the rigidity given by the massive pier. The heavy abutments are of gravity section, with wing walls and expansion plates.

The longitudinal girders are on 14-foot centers, with 20-inch cross floor beams resting on their lower flanges, spaced on about 30-inch centers. The main girders are cross braced by knees about 8 feet apart, extending up from the floor beams.

A reinforced concrete slab, about 6 inches thick, covers the floor beams, its finished surface where it meets the knee braces, extending up the slope of the latter to the girders, covering the knees about an inch thick. To reduce the weight of concrete in the triangular spaces between these slopes and the girders, this space is partly filled with hollow tile. The floor slab is covered with a water-proofing of coal tar and paper, applied according to Barrett's specifications, the waterproofing in turn covered by a two-inch concrete coat partly reinforced with wire mesh. The floor slab drains into tile drains running down the sides of the roadway to the ends of the bridge. The base of the rail is about two feet above the top of the floor slab, the space between filled with gravel, so that the track can be ballasted, raised or re-lined like any other part of the road bed, thus assuring continuity of track structure and reducing impact and jarring effects from passing trains.

**Bridges Over Mud Run.** The Erie and Big Four are here on 60-foot centers, each road being carried by a separate concrete bridge, of three spans, the middle one a 40-foot three-centered arch, and the others 25-foot circular arches. Both bridges are of

the standard 20-foot width over all, with the base of rail at the same elevation as the top of the filled spandrel walls. The arches are designed to carry the dead and live loads without reinforcement, but with a liberal allowance of additional steel reinforcement to provide for temperature stresses.

While the bridges are independent structures, the wing walls between them are built as a unit, poured as a continuous section, with an expansion joint where they join the abutments. Heavy pilasters reinforce the ends of each pier, tied together by steel across the bridge, to help carry the thrust of the earth filling under the track structure. The spandrel walls themselves are reinforced, so that the earth pressure is largely resisted by cantilever action.

The masonry rests on a gravel formation containing some clay and sand. Into this piles were driven sufficient to carry the entire load of the structure. Thus the creek bed may suffer considerable scour without danger to the stability of the bridges.

**Long Culverts Under Levees.** As explained elsewhere, the Big Four and Erie pass the south end of the Huffman Dam in a cut 35 feet below the dam crest, and enter the retarding basin at a corresponding distance below the maximum flow line, requiring thus to be protected against flood by levees on each side. These levees (see Fig. 201), are 200 feet apart and have a maximum height of 35 feet. To carry the surface drainage into Mad River valley from the hills to the south, long culverts are provided passing under both tracks and both levees.

A typical culvert is that designated as Bridge 154. This is a standard 12-foot circular concrete arch, with a length between head walls of about 275 feet. In times of extreme flood, the water in the retarding basin will back up the valley slopes through these culverts to a considerable height above track level. To prevent the water seeping under the side walls into the road bed, the culvert is floored with concrete. Longitudinal seepage is checked by cut-off walls over the top of the arch under each levee.

**Triple Box Culvert at Tate's Point.** The railways at this point cross a creek on a structure consisting of three 12-foot reinforced box culverts built as a unit. This structure has a skew of 20 degrees, with the normal. The roof slabs of the culverts are designed as simple beams, the haunches being neglected in the calculation. Sufficient steel is provided over the piers to take care of negative bending moments. The haunches are added to afford additional resistance against tractive forces.

In the design of these culverts, stresses of 16,000 pounds were allowed in the steel and of 700 pounds in the concrete. The abutments were required to carry the load from a 7-foot surcharge. Both the abutments and the wing walls have a gravity section, and are separated from each other by joints.

### Third Report of the Board of Directors Now Being Printed

The Third Report of the Board of Directors of the District to the Conservancy Court is in the hands of the printers. It will no doubt be delivered to the judges before the next issue of the Bulletin, and we shall therefore hope to present the gist of it to our readers at that time.

## The New Big Four and Erie Interlocking Plants

Interesting features of the railway relocation are the two interlocking systems. One of these protects its intersection with the cut-off connecting the Baltimore and Ohio Railway main line (Dayton-Toledo) with the Welston Division of that road, at Tate's Point, just outside the city limits of Dayton. The other is at Fairfield, to take the place of the old interlocking plant at Osborne, serving the Big Four and Erie. The first is primarily and mainly for safety; the second is also for convenience in switching and crossing over between the two last named roads, there being no railway intersection at this point. Both are block stations; that is, both indicate to locomotive enginemen clearance or occupancy of an entire block of the railway, east or west of the tower as the case may be. The operation is in part automatic (the signals set electrically by the train), and in part manual, by means of tower operators, the latter being also in telephonic and telegraphic communication with Division headquarters, and reporting the movement of all trains to the dispatchers, as at any regular railway station.

The fundamental point in the design of any interlocking plant is safety, and this has been carried to a remarkable efficiency. Such a plant is in fact "fool-proof" in this regard. A green operator cannot set switches and signals which will permit trains to collide; at the worst he can only "ball things up" by "clearing" tracks which are not wanted, and blocking tracks which need to be "cleared."



FIG. 207—INTERLOCKING PLANT AT TATES POINT. SEPT. 20, 1920.

The view is toward Dayton. The right track is the westbound, the Erie. The left is the eastbound, the Big Four. The transverse track is the cut-off from the Baltimore & Ohio main line to the Wellston Division (at the left) of the same road. Thirty-four levers in the tower operate all the switches, derails and signals in the system, the transmission being mechanical (by jointed pipes,) for switches and derails, and electrical or mechanical for the signals.

This desideratum is secured by means of the interlocking machine, that used at Tate's Point and Fairfield being the Saxby and Farmer design, made by the Union Switch and Signal Co. The operating levers of all the switches, derails and signals in the system are brought to this machine and set side by side. (See Fig. 209). By an ingenious mechanism, these operating levers are interconnected, so that any lever can be made to lock or unlock any other in the system. With all the levers thrown back (to

the left in Fig. 209), every signal in the system is set to "stop," and every switch and derail is thrown open, so that no train can approach the tower from any direction without first being warned off, and then, if it disregards the warning, derailed. To open any route through the system (as the B. & O. cut-off east, described under Fig. 209), the levers can be thrown only in a predetermined order, each lever as it is thrown unlocking the next, switches and derails first, then the signals, thus opening a clear route before signalling the train to come on. In addition, the first lever thrown locks the levers of all conflicting routes (these being already in the "stop" position), so that they cannot be opened until the route in use is again closed by throwing all its operating levers back again, in reverse order.

Study of what has just been said will make it clear that such a system is by its nature "fool-proof," as above indicated. No route can be opened until all conflicting routes are closed; and no signal to proceed set until the track is first cleared.

This universal interlocking is obtained by means of two sets of horizontal bars, the bars of a set laid "side by each," one set at right angles to the other and just above it. Each set has a bar for the operating lever of every switch, derail and signal in the system, the bar being connected to its lever by mechanism so as to slide a short distance endwise as the lever is thrown. Projecting bolts or "dogs" on one set of the bars slide in and out of corres-



FIG. 208—THE INTERLOCKING PLANT AT FAIRFIELD. SEPT. 20, 1920.

The tower is of structural steel, carrying a frame building of wood above. At Tate's Point the entire structure is brick. The double cross-over appears just beyond the cross pipes in the foreground. These pipes lead back to the tower, where they are worked by the levers shown in Fig. 209. The two cross pipes work, one the switch and the other the switch lock, belonging to the switch at the left in the foreground.

ponding notches cut in the other set, if the notched bars are in proper position. But if a notch is slid along by the motion of the bar carrying it, the corresponding dog is no longer in line, and strikes the bar instead, thus preventing motion. In this way any lever can be "locked" until the interfering bar is again slid back, once more permitting free motion.

At either of the new towers on the Big Four and Erie railway relocation there are 44 of these levers and bars, of which only about 34 are now operated,

The levers, several of which are shown thrown to the right, operate the mechanism, there being a lever for each switch, derail, lock and signal in the system, and also for every switch and derail lock. (See Fig. 208.) The levers at the right are thrown for an out-bound train (from Dayton) from the B. & O. main line over the cut-off to the Wellston Division. The first two throw and lock the switch from the cut-off to the Wellston Division. The next two close and lock the derail protecting the Big Four and Erie from out-bound trains on the cut-off. (The switch first thrown

(Continued below)

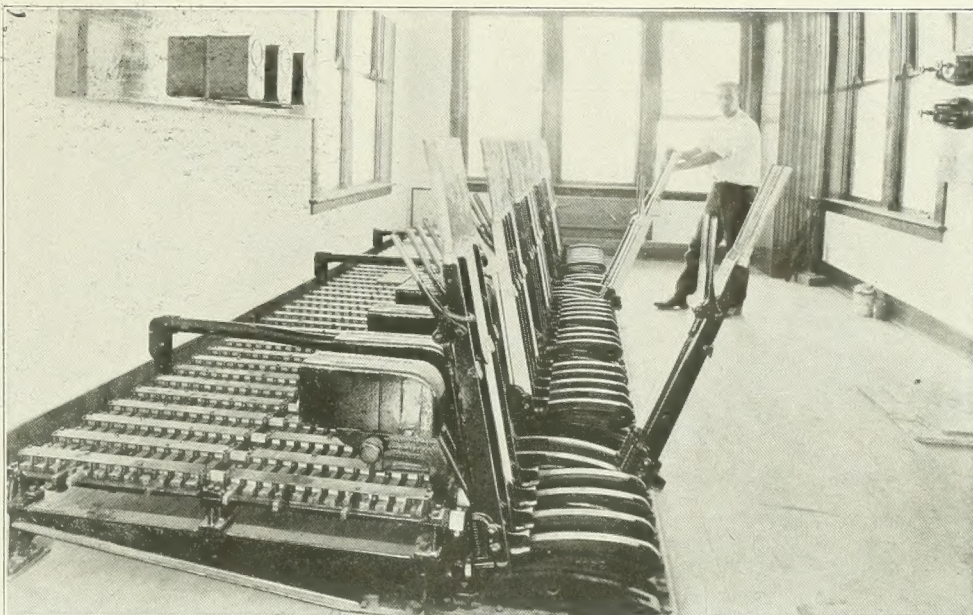


FIG. 209—INTERIOR OF INTERLOCKING TOWER AT TATES POINT. SEPT. 23, 1920.

normally acting as a derail for trains on the cut-off bound in.) The next sets an "advance" signal to "stop" for trains coming in over the Wellston Division which might be around the hill to the east. The next sets a signal beside the thrown derail to the position "proceed," and the next sets a distant signal, several thousand feet down the cut-off to the west, to the same "proceed" position, both these signals telling the engineman of the oncoming train on the cut-off that the track is clear for him. Thus the switches and derails are set first, and the signals last; and the levers are so interconnected that it is impossible to reverse this order. The row of boxes to the left of the levers cover electric switches which operate the distant signals, these switches being connected each to its proper operating lever by mechanism. The two sets of rectangular bars which constitute the interlocking mechanism between the levers, (see page 46,) is seen at the left of the levers and below the switch covers.

the remainder being in reserve for future track additions. Thus at Fairfield there are 35 working levers, which operate the switches and derails on two passing tracks, two team tracks, and two cross-overs, and also the mechanism of 23 signals.

It will be noted that besides the safety feature in this system, there is also a factor of convenience, due to the fact that every switch and signal lever is brought to the central tower. One man thus does all the switching in the "yard" from the one point, saving time and labor of switchmen running about on foot.

In the towers here described, an additional factor of safety is introduced, in addition to that mentioned. Suppose the signal set to "clear" on the east bound track for an approaching Big Four train at Tate's Point. As soon as the train reaches the signal, the semaphore arm drops to the "stop" position, indicating to a following train that the block is occupied. This is accomplished electrically, by means of a little electric motor on the signal mast, connected to a primary battery in the interlock tower, the circuit being automatically closed by an electromagnet on the locomotive as it passes the signal mast. The same electric current locks the levers in the tower also, so that the operator there cannot if he would, open a switch or clear a signal on any conflicting track.

A further word as to the signals. They are carried on two semaphore masts, placed in line at right angles to the tracks, one for each track. (The Big Four and Erie being operated in conjunction between Dayton and Enon as one double track system). Three signals, placed one above the other, are on each mast. The upper signals, set to "clear,"

mean "high speed ahead." The middle signals mean "caution"—reduced speed ahead and be on the lookout. The lower signals mean "low speed ahead and expect a train on the block, a broken rail or other obstruction." If any arm is dropped to the horizontal position, it means "stop." If it is vertical, it means "track clear."

The old system reversed these latter indications. A dropped arm meant "track clear, go ahead." The reason for the change is important. If there were a break in the mechanism, or if sleet froze on the arm perhaps, on the old system the arm dropped to "clear" of its own weight, when the track ahead might in fact be occupied. Now, in a similar case, it drops to "stop," and trains are held up till the mechanism is put right again.

Another feature is that whether needed or not, there are always three signals on each mast. Thus there are three signals on each mast at Tate's Point, although the middle set, meaning "reduced speed," is never used there under the conditions. It is always cleared for "high speed," or "low speed." The installation of three sets of signals where only two are used is on the principle of uniformity of appearance. The engineman, always seeing the same number of signals on a mast, all changes of appearance mean action, either go ahead, or stop. No unnecessary changes in appearance distract his attention.

Both interlocking plants were placed in operation on September 3, when the diversion of traffic on the Big Four was made. The installation was made under the direction of Mr. C. F. Stoltz, Signal Engineer of the Big Four R. R., the work being done by that railway's signal forces, under the direct supervision of General Signal Foreman J. P. McGill.

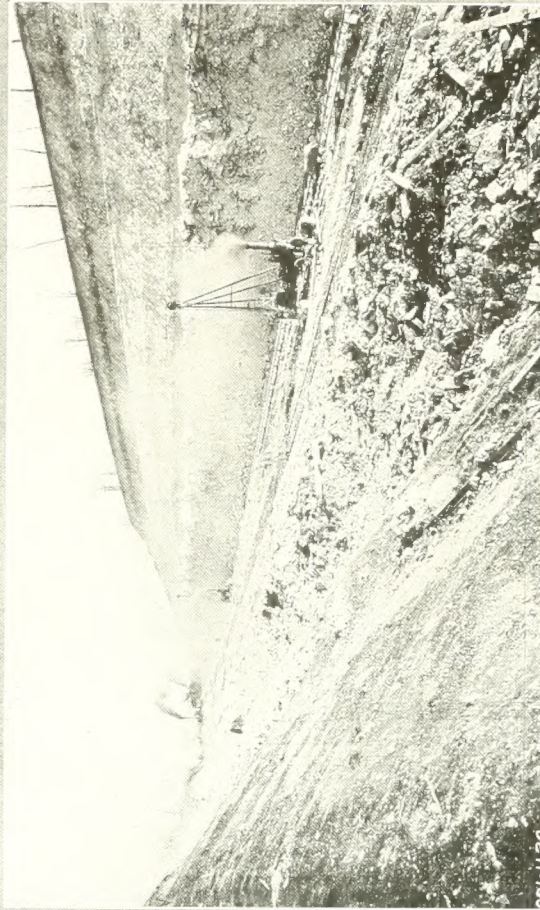
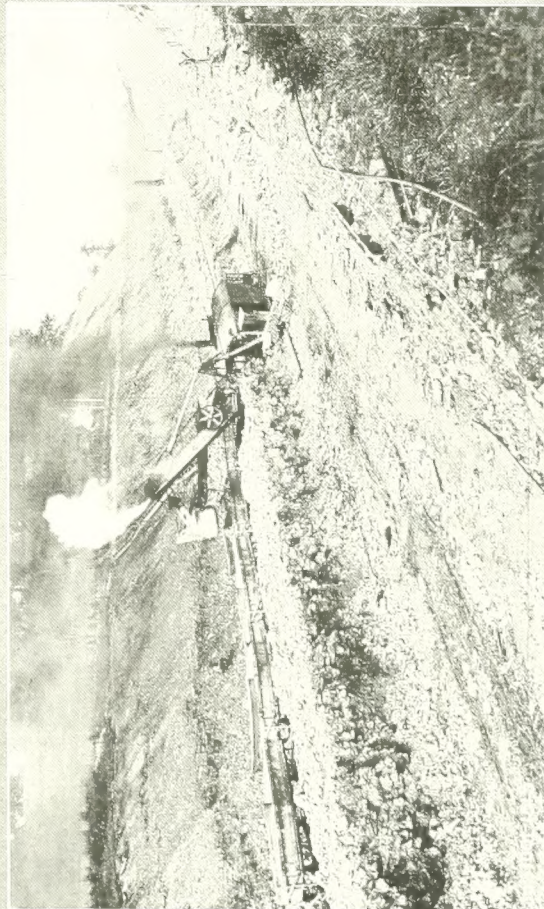
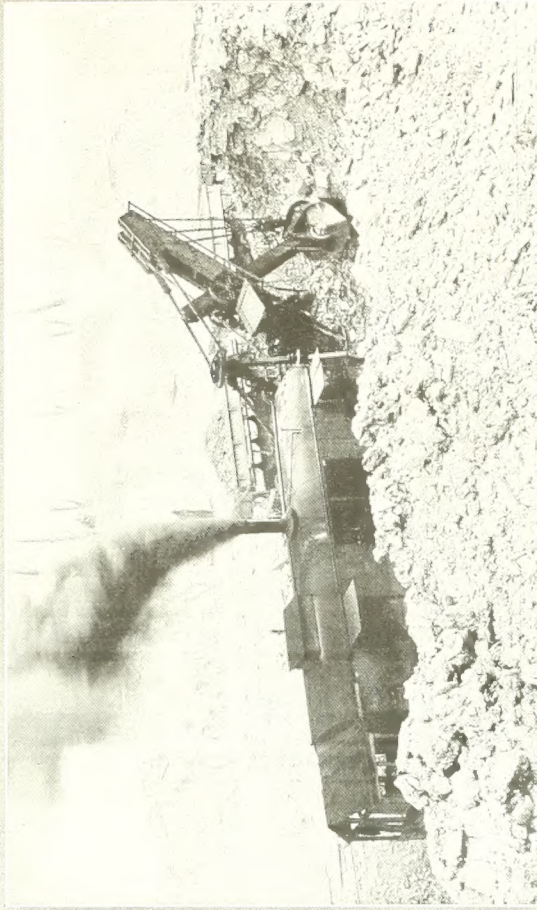


FIG. 210—WORKING IN THE BIG ROCK CUT AT HUFFMAN.

Number 1 shows the softness of the Elkhorn layer of rock, the marks of the steam shovel dipper being plainly visible in the face of the cut all along the excavation. This rock could have been taken out without blasting, but at an excessive cost.

Number 2 shows how the rock was blasted in a long windrow ahead of the steam shovel, the latter then following and loading the shattered material into the cars.

Number 3 is a close-up of the shovel, a 70-C Bucyrus, which did the major part of the rock excavation. This type is especially well fitted for this class of work.

Number 4 shows the full scope of the work of excavation, with two well drills in operation nearest the observer, and the steam shovel, dump car train and Ingersoll rock drills at work further down, with finished cut at left and above.